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10/518,038	12/13/2005	Shoou-I Wang	2443.002US2	3598

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EXAMINER	
GREGORIO, GUINEVER S	

ART UNIT	PAPER NUMBER
1793	

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/518,038	WANG ET AL.	
	Examiner	Art Unit	
	GUINEVER S. GREGORIO	1793	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *01/02/2009*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-28* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-28* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

5) ☐ Notice of Informal Patent Application

6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

The factual inquiries set forth in *Graham* **v.** *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

1. Claims 1-28 are rejected under 35 U.S.C. 103(a) as being unpatentable over Allam et al. (U.S. Pub. No. 2002/0103264 A1) in view of Horton (U.K. Pub. No.

2,168,718 A). Allam teaches synthesis gas generation system comprising a partial oxidation, hereinafter POX, of hydrocarbon and a secondary gas heated catalytic reformer, hereinafter GHR, in combination (paragraph 28). Allam teaches partially oxidizing hydrocarbon fuel gas in the presence of oxygen gas in the POX to produce a first intermediate synthesis gas stream which corresponds to exothermically reacting hydrocarbon containing fuel with an oxidant gas comprising molecular oxygen in a first reactor to produce an exothermically-generated syngas product (paragraph 29). Allam teaches the excess heat generated from the POX may be used to heat the GHR (paragraph 10). Allam teaches reforming hydrocarbon fuel gas with steam in the GHR to produce a second intermediate synthesis gas stream and combining said intermediate synthesis gas streams to produce the synthesis gas product stream which corresponds to endothermically reforming hydrocarbon-containing fuel gas with steam over a catalyst in a heat exchange reformer to produce a heat exchange-reformed syngas product, wherein at least a portion of the heat required in the generation of said heat exchange-reformed syngas product is obtained by recovering heat from reacted syngas product thereby cooling said reacted syngas (paragraph 30). Allam does not teach a step between POX and the heat exchanger which would correspond to combining a stream of reactive diluent fluid with a stream of said exothermically generated syngas product to produce a reactive mixture, reacting said reactive mixture in a catalytic second reactor to produce a reacted syngas product.

2. Horton teaches it is known in the art that raw synthesis gas leaves primary process units at very high temperature and the temperature is so high that very

expansive means are needed to contain it and cool the gas to a more manageable temperature (page 1, lines 16-23). Examiner takes the position that it is well known in the art the composition of the raw syngas stream is conducive to dusting of metal surfaces in downstream heat transfer equipment at certain temperatures (As evidenced by Prasad US 2002/0155061, paragraph 23). Furthermore, it is well known metal dusting is a catastrophic carbonization of the alloy which results in the formation of internal carbides that create pitting and thinning of metal structures in relatively short periods of time. Two methods are currently employed in an attempt to prevent metal dusting. One known method to prevent metal dusting is to keep metallic surfaces such as heat exchanger walls at temperatures outside the critical range by having boiling water on one side of the wall or cooling a syngas product stream by quenching with water. Another method is to use a metal that is resistant to metal dusting. Horton teaches combining the raw syngas from a primary process with carbon dioxide and then passing the resultant mixture through a catalyst which causes some of the carbon dioxide to react with hydrogen to form additional carbon monoxide which is known in the art as back shifting or reverse water gas shift (page 1, lines 23-28).

3. It would have been obvious to one of ordinary skill in the art at the time of the invention to incorporate the method of reducing the temperature as taught by Horton with the POX primary syngas production unit as taught by Allam because the method taught by Horton is an efficient process which reduces the temperature of the raw synthesis gas and can potentially prevent the metal dusting of the heat exchange reformer.

4. Regarding claim 2, Allam teaches reforming hydrocarbon fuel gas with steam in the GHR to produce a second intermediate synthesis gas stream and combining said intermediate synthesis gas streams to produce the synthesis gas product stream which corresponds to endothermically reforming hydrocarbon-containing fuel gas with steam over a catalyst in a heat exchange reformer to produce a heat exchange-reformed syngas product which corresponds to said heat exchange-reformed syngas product is combined with said reacted syngas product prior to heat recovery (paragraph 30).

5. Regarding claims 3, and 8-17 Horton teaches various carbon dioxide sources such as carbon dioxide removed from the effluent of the back shifting reactor, or removal of carbon dioxide from the natural gas feed or flue gas, or down stream from a stream which arises in the downstream processing of the effluent of the back shift reactor (page 1, lines 35-47). Horton also teaches carbon dioxide can be imported from an external source such as an ammonia or fermentation plant or carbon dioxide well. Examiner takes the position that no matter what the source of the carbon dioxide gas is that the carbon dioxide used in the process taught by Horton will have a substantially lower temperature than the raw synthesis gas created by the POX process taught by Allam. Hence, Examiner takes the position that the carbon dioxide will control the temperature of the exothermically-generated syngas product when the syngas and reactive diluent are mixed. Furthermore, Examiner takes the position that there is a high likelihood carbon dioxide which has been recycled from the natural gas feed or downstream from the back shift reaction contains some hydrocarbons which are remnants from the POX reaction or the stream reforming reaction and will the carbon

dioxide from these gas streams will have a substantially lower temperature than the ray synthesis gas produced by the POX. To conclude it would have been obvious to one of ordinary skill in the art at the time of the invention to incorporate the method of reducing the temperature as taught by Horton with the POX primary syngas production unit as taught by Allam because the method taught by Horton is an efficient process which reduces the temperature of the raw synthesis gas and can potentially prevent the metal dusting of the heat exchange reformer.

6. Regarding claims 18-20, water is a known product of reverse water gas shift and therefore the reaction taught by Horton would obviously contain water in various forms such as steam and liquid. It would have been obvious to one of ordinary skill in the art at the time of the invention to incorporate the method of reducing the temperature as taught by Horton with the POX primary syngas production unit as taught by Allam because the method taught by Horton is an efficient process which reduces the temperature of the raw synthesis gas and can potentially prevent the metal dusting of the heat exchange reformer.

7. Regarding claim 6, Horton teaches combining the raw syngas from a primary process with carbon dioxide and then passing the resultant mixture through a catalyst which causes some of the carbon dioxide to react with hydrogen to form additional carbon monoxide which is known in the art as back shifting or reverse water gas shift (page 1, lines 23-28). It would have been obvious to one of ordinary skill in the art at the time of the invention to incorporate the method of reducing the temperature as taught by Horton with the POX primary syngas production unit as taught by Allam

because the method taught by Horton is an efficient process which reduces the temperature of the raw synthesis gas and can potentially prevent the metal dusting of the heat exchange reformer.

8. Regarding claim 4, Allam teaches pure oxygen which corresponds to molecular oxygen (paragraph 8).

9. Regarding claim 5, Allam teaches reacting hydrocarbon fuel gas with steam and/or oxygen gas in a synthesis gas generation system to produce a synthesis gas product stream which corresponds with hydrocarbon fuel is reacted with the oxidant gas in the presence of water (paragraph 20).

10. Regarding claim 7, Examiner takes the position that it is known in the art for soot to form during POX and therefore since Allam teaches POX then soot would obviously be formed during the process and would be present in the reactive mixture wherein the reactive mixture is treated with a reverse water gas shift reaction.

11. Regarding claim 21, Allam teaches synthesis of hydrocarbon oils/waxes and methanol which corresponds to hydrocarbon liquid fuels, and methanol (paragraph 1)

12. Regarding claims 22-24, Horton teaches hydrogen is necessary in a reverse water gas shift reaction (page 1, lines 23-35). It would have been obvious to one of ordinary skill in the art at the time of the invention to incorporate the method of reducing the temperature as taught by Horton with the POX primary syngas production unit as taught by Allam because the method taught by Horton is an efficient process which reduces the temperature of the raw synthesis gas and can potentially prevent the metal dusting of the heat exchange reformer.

13. Regarding claims 26 and 27, as stated supra the process of combining steam and or water with syngas is known in the art to prevent metal dusting.

Response to Arguments

14. Applicant's arguments with respect to claims 1-28 have been considered but are moot in view of the new ground(s) of rejection.

15. Examiner used Prasad as a primary reference because Prasad teaches various methods for producing crude syngas. For example Figure 1 teaches an adiabatic performer, a two-stage oxygen transport membrane reactor and an autothermal reformer (paragraph 8 and 16). Prasad teaches steam and/or carbon dioxide can be added to the oxygen for both the two state oxygen transport membrane reactor and the autothermal reformer. The carbon dioxide feed mixed with the raw syngas produced from the oxygen transport membrane reaction corresponds to carbon dioxide Prasad teaches an alternative method for the production of syngas. Prasad teaches a multistage method of producing syngas in which a catalytic partial oxidation unit is used for feed pretreatment which is then subsequently fed into a fired reformer (paragraph 28). Prasad teaches steam and or carbon dioxide can be added to the oxygen stream for the fired reformer (paragraph 10). Examiner takes the position that both methods taught by Prasad teach the addition of carbon dioxide after an exothermic oxidation reaction and when the carbon dioxide is introduced a physical reaction, cooling of the feed stream, occurs. Examiner acknowledges that the reference has been defeated by applicant’s amendment to the claim wherein the carbon dioxide is introduced to the raw syngas and then reacted in a <u>catalytic</u> reactor. Therefore, Examiner was required to do

a new search and change the rejection because of the amendment to the independent claim.

16. Furthermore, Prasad teaches metal dusting which is known in the art to be a catastrophic carbonization of alloy metals resulting in the thinning of metal structures that imminently leads to the destruction of heat exchangers (paragraph 23).

17. Examiner used Allam as a secondary to define the various processes recited by Prasad. Prasad did not define partial oxidation as an exothermic process used to generate carbon monoxide. Nor did Prasad define autothermal reforming. A reasonable explanation that Prasad did not define the process is because the definitions are known in the art and Prasad reasonably concluded one of ordinary skill in the art would know what would constitute an autothermal reforming process. Examiner used Allam merely for the definitions so that one not of ordinary skill in the art or a lay person would be able to read the office action and reasonably conclude the definitions for partial oxidation reactions and autothermal reactions and various other reactions are well settled in the art.

Conclusion

18. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

19. Malhotra teaches a process for producing hydrogen comprising catalytically reforming a first hydrocarbon portion with steam and air in and autothermal reaction, hereinafter ATR, (paragraph 7, lines 1-6). Applicant acknowledges on page 2 lines 22-

33 and page 3 lines 1-5 of applicant's specification that ATR is a partial oxidation burner followed by a catalyst bed with a feed of natural gas team and oxygen and the oxidation reaction in ATR is exothermic with the production of syngas at elevated temperature from 900 to 1100 ºC. Therefore examiner takes the position that the ATR step taught by Malhotra et al. corresponds with an exothermically reacting hydrocarbon-containing fuel with an oxidant gas comprising molecular oxygen in a first reactor to produce an exothermically generated syngas product. Malhotra teaches supplying the first syngas effluent to a reforming exchanger and passing a second hydrocarbon portion with steam through a catalyst zone in the reforming exchanger to form a second syngas effluent which corresponds with endothermically reforming hydrocarbon-containing fuel gas with steam over a catalyst in a heat exchange reformer to produce a heat exchange-reformed syngas product wherein at least a portion of the heat required in the generation of said heat exchange-reformed syngas product is obtained by recovering heat from said reacted syngas product thereby cooling said reacted syngas (paragraph 7, lines 5-10).

20. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to GUINEVER S. GREGORIO whose telephone number is (571)270-5827. The examiner can normally be reached on Monday-Thursday, 10:30-5:00 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Curt Mayes can be reached on 571-272-1234. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Gsg
March 10, 2009

/Melvin Curtis Mayes/
Supervisory Patent Examiner, Art Unit 1793